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ABSTRACT

This study compared the performance of 300 Chinese children on the Boehm Test of Basic Concepts-Revised (BTBC-R) with that of American children from the standardization sample of the BTBC-R. Subjects were in kindergarten, first, and second grade, and completed the test at the end of the 1996-97 school year. The focus of the comparison was to determine: (1) will lexical diversity and morphological complexity affect the rate of acquisition of the basic relational concepts between children who speak distinctly different languages; and (2) to what extent do conceptual factors interact with linguistic differences in children's development of basic relational concept. The comparison showed that Chinese children acquired significantly more basic relational concepts than their American peers at both first and second grades but not the kindergarten level. This difference in acquisition was examined in terms of language characteristics of the two languages, and nonlinguistic factors were examined in terms of cultural and parental influences on young children's conceptual development. (Contains 17 references.) (Author/KB)

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Chinese and American children's Knowledge of Basic Relational Concepts

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Abstract

Three hundred children from kindergarten, 1st and 2nd grade in Beijing, China were given the Boehm Test of Basic Concepts-Revised (BTBC-R) at the end of 1996-97 school year. Their performance was compared with that of American children from the standardization sample of BTBC-R. This study explores two questions: 1) Will lexical diversity and morphological complexity affect the rate of acquisition of the basic relational concepts between children who speak distinctly different languages? and 2) To what extent do conceptual factors interact with linguistic differences in children's development of basic relational concepts. Results showed that Chinese children acquired significantly more basic relational concepts than their American peers at both 1st and 2nd grades but not at the kindergarten. This difference in acquisition is discussed in terms of language characteristics of the two languages. Nonlinguistic factors are discussed in terms of cultural and parental influences on young children's conceptual development.

Introduction

Basic relational concepts, including those of space, quantity, and time, are important to the development of thinking skills and for complying with teacher's classroom instructions (Boehm, 1976, 1984; 1990; Siegler, 1998). "These concepts develop among children in all cultures, and probably at all times in history. All have their origins in development. All also develop in ways that reflect the influence of the surrounding culture" (Siegler, 1998, p.226). Children across cultures use the basic concepts to describe objects, to explain events, and to organize their experiences (Boehm, 1990). Basic concepts are building blocks for thinking and problem solving (Boehm, 1976; Klausmeier, 1976, 1992) as well as the basic units of learning and instruction (Carroll, 1964). Furthermore, research has demonstrated that preschool and primary school children who have received instruction in basic concepts demonstrated gains in both their concept understanding and on standardized achievement tests (Armour-Thomas, 1984). The relationship between basic relational concept knowledge and school achievement has been supported by studies in the mainland United States (Piersel & McAndrews, 1982) and in Puerto Rico (Nason, 1986).

Because basic relational concepts are fundamental to developing cognitive skills, corss-lingusitic differences in the development of basic concepts constitute an issue of considerable importance. Literature on cross-lingusitic differences in the acquisition of basic relational concepts has been scarce and is limited to a subset of concepts. In fact, no empirical research has yet been reported on the children's mastery of a more complete set of a basic relational concepts. A cross-cultural/cross-linguistic approach is ideal for two reasons: First, by describing ability across different languages, the question as to whether acquisition of basic concepts is a linguistic or a cultural universal can be examined. Second, attempts can be made to explain any significant differences in the acquisition of basic concepts between the cultures in terms of linguistic complexity as well as conceptual diversity, or the interaction of both. The existing literature (e.g., Johnston & Slobin, 1979) is limited to the comparison of European languages. No empirical study has directly compared the acquisition of a larger set of basic relational concepts among children who speak very distinct languages such as English and Chinese. Two questions can be raised: 1) Will lexical diversity and morphological complexity affect the rate of acquisition of the basic relational concepts between children who speak distinctly different languages? And 2) To what extent do conceptual factors interact with linguistic differences in children's development of basic relational concepts. Crosslingusitic studies in this area are particularly important in revealing aspects of cognitive and linguistic competencies, and the relations between the two that are seldom found in the studies of preschoolers' language and cognition.

Methods

Participants

A total of 300 hundred children (100 hundred at each grade level, kindergarten through 2nd grade) in Beijing, China participated in this study at the end of the 1996-1997 academic year. Mean age (month) was 6 years 2 months for kindergarten children, 7 years, 4 months for 1st grade, and 8 years, 4 months for 2nd grade. All children were from families of average income. Most parents were high school graduates. The parents were government employers working in factories, department stores, etc. Middle-class American children in the standardization sample of the BTBC-R were included for comparisons with the Chinese children. End-of-year norms were used to make the comparison.

Materials and Procedures

All children were administered Booklets 1 and 2 (Form C) of Boehm Test of Basic Concepts-Revised (BTBC-R) (Boehm, 1986), a test which measures children's receptive understanding of basic relational concepts. The test was translated into Chinese by the first author and then was back translated by another native Chinese speaker who is highly proficient in English and had not seen the original version of BTBC-R. Minor discrepancies in translation were resolved through discussion. Group administration was performed with roughly 30 to 35 children in each group. Children were seated sparsely to avoid the possibility of a child looking at another's booklet. For each group, one examiner and two teachers were present to ensure that all children were working on the correct test item. The BTBC-R was administered by the first author and two graduate students in the Institute for Child Development at Beijing Normal University who were trained by the first author in test administration.

Results

This study compares basic concept acquisition of kindergarten, 1st and 2nd graders in mainland China with their American peers from the standardization sample of BTBC-R.

Due to the difference between the Chinese sample size and the norms (e.g., 100 Chinese children at each grade level vs 1370, 1295, and 1142 sample size for the kindergarten, 1st, and 2nd grade, respectively from the normative data provided for the BTBC-R), effect sizes for differences between proportions, h, (Cohen, 1988) are reported which give more meaningful information because the sample size is no longer a concern (See Tables 1). In order to make meaningful interpretations, only medium and large effect sizes for differences between proportions are interpreted.

We are interested in two types of information: 1) the overall percent of items passed by all (i.e., 100%) or by most children (95% or more) in both cultures, and 2) particular concepts passed by significantly more children in one culture, but not by the other.

Children's Acquisition of Concepts

At the 1st grade, 6 out of 50 concepts (12%) was mastered by all (100%) American children. For the Chinese, 21 out of 50 concepts (42%) was mastered by all the children. The difference between the two groups was significant ($z=6.38$, $h=.80$, $p<.001$). At the 2nd grade

level, 17 out of 50 (34%) concepts was mastered by all American children. In comparison, 33 concepts (66%) was mastered by all Chinese children. The difference between the two groups was again significant (z=6.48, h=.65, p<.001). The group difference was not significance at the kindergarten level.

When the percent of children passing each item was lowered from 100% (all children passing the item) to 95% and above children passing the item, we found significant difference only at the 2nd grade level.

Cultural Differences on Children's Acquisition of Particular Concepts

At the kindergarten level, when both Z score and effect size (h) were considered, we found significant cross-cultural differences on eight concepts. The Chinese children showed better understanding than their American counterparts on separate, narrowest, fewest, center, before, below and above with the large effect size for the first three concepts and the medium effect size for the last three concepts.

At the 1st grade level, the number of concepts on which the Chinese demonstrated better mastery increased. Significant cross-cultural differences were found on 13 of 50 concepts. These concepts include narrowest, fewest, a pair, medium, right, separate, left, different, a few, match, third, between, and above with the first two showing the large effect size and the rest showing medium effect size. American first graders did not show any advantage over Chinese children in understanding any particular concept.

At the 2nd grade, Chinese children's superiority in concepts acquisition persisted but limited to fewer concepts. Significant difference was found on the concept of narrowest, fewest, a few, after, right, all showing the medium effect size.

Discussion

The study of young children's understanding of relational concepts is one of the essential and defining features of human cognition (French & Nelson, 1985). It has become clear that different languages pose different types of acquisition problems (Slobin, 1982). The absolute age of acquisition of various relational terms also differ between languages (Slobin, 1985). An examination cross-linguistically of children's acquisition of relational terms helps us to account for the two interacting variables: conceptual development and the influence of factors of linguistic complexity (Johnston & Slobin, 1979).

Impact of Language Characteristics and the Acquisition of Basic Relational Concepts

To understand cross-cultural difference in performance, we need to look at the language characteristics in relation to the specific concepts on which the Chinese children demonstrated superiority and consider possible explanations for these outcomes.

Chinese and English are written with two of the world's most diverse writing system (Stevenson, 1987). Chinese children's learning of the Chinese language is governed by special principles. These principles are closely related to the characteristics of the Chinese language and to the cognitive abilities of children. These principles include: 1) characters and writing, 2) characters and words, 3) the formation of superlative, 4) the Chinese ordinal number system, and 5) the precise meaning of the Chinese words.

Chinese characters and writing. Written Chinese uses logographs. Each Chinese character is in a shape of a square with a clear distinction between top and bottom, left and right, and inside and outside. When a child begins to learn to write Chinese characters at about age 4 or 5, he or she has to have a clear understanding of these spatial orientations in order to follow adult's instructions in character writing. These spatial concepts are reinforced through instructions in children's early years.

Chinese characters and words. A Chinese word is constructed of one or more characters. Although the Chinese vocabulary is large, the number of characters from which its words are constructed is relatively small (Fan, et al., 1987). In the Chinese vocabulary, a great proportion of words is composed of two characters serving as morphemes. Some words are composed of all familiar characters, while other words are composed of a combination of familiar as well as unfamiliar characters. Quite often, a child can often infer the meaning from the familiar character even though he or she has never come across the other unfamiliar character in a compound word. The convenience of utilizing the familiar character in a compound word provides the Chinese children great advantage in understanding words and concepts.

The formation of superlative. At both kindergarten and the 1st grade, the two concepts that showed large effect size are narrowest and fewest. For these two concepts, morphological factors might explain the ease of mastery with which the Chinese children master these concepts at an early age. In English, *-est* is the suffix added to the adjectives to form the superlative. In Chinese, the adverb " zui" (most) is added before the adjective to commonly

express degree. For example, zui gao "the most tall", zui xian "the most delicious". In our case, narrowest in English becomes "the most narrow" in Chinese and fewest in English becomes "the most few" in Chinese. We speculate that ability to understand and use the suffix such *–est* is linguistically more demanding. On the other hand, for Chinese children adding a character " 最 " (most) does not involve increased morphological complexity and its meaning is very straight forward.

The Chinese ordinal number system. The Chinese language has a regular structure to form the ordinal number system. The prefix " 第 "(di) It occurs affixed to numerals, forming complex nominals like disan "the third", diwu "the fifth", diwushisan "the fifty third." Because of its regularity in forming the ordinal number system, the Chinese young children are able to grasp the ordinal number concepts at a relatively young age.

The precise meaning of the Chinese words. Quite often, when a single Chinese character is combined with another character to form a word, this word expresses the precise meaning. For example, the word " chi fan" (吃飯) is composed of two characters—"eat" and "rice". One of the plausible reasons that Chinese children outperform the American children on their understanding of basic relational concepts is that meaning of a concept in Chinese is conveniently expressed in the characters that form the concept. These concepts include: medium (中等)—middle size; center (中間) –middle; separated (分開的)–apart; different (不同)—not same, match (和...相稱)—similar to another, pair (一雙)—a couple, a few (一些)—some. Table 2 lists the language characteristics of the concepts that show cultural difference.

Cultural and Parental Influences on Cognitive Development: Children of only-child families in China

Cultural context in general and parental socialization in particular (i.e., parental beliefs and behaviors) affect children's intellectual development. Since the initiation of a one-child family policy in 1971, psychologists as well as educators in China have been interested in questions such as: Are only children intellectually better developed than children with siblings? What are the characteristics of these children? (Jiao, Ji, & Jing, 1996). The results from research studies point to the same conclusion: only children fared remarkably better in cognitive abilities and some areas of social development than their sibling peers in early elementary years. Such superiority can possibly be explained by the extraordinary attention

and personal sacrifice of the parents invested in their only children in order to provide an enriched environment that can greatly facilitate the children's cognitive and social development (Jiao, Ji, & Jing, 1996). The parents are extremely concerned about their children's success in the future. Driven by the desire for their children to succeed, the parents spend a lot of time interacting with their children, buying books for them, and involving them in the events that are intellectually challenging. The stimulation that these children receive result in the great advancement of language abilities, which may be seen as a key to the development of other cognitive abilities, such as the basic relational concept development examined in our study.

The finding from this study has important implications for educating multicultural American children. With an increasing number of students from diverse cultural/linguistic background entering the inner-city public schools, it would be important for teachers, school psychologists, and language pathologists to understand characteristics of language structure which would influence learning and be considered in intervention. When we understand the differences in the structure between English and other languages and how language characteristics impact on conceptual development, then we are better able to conduct more valid psycho-educational assessment, develop more effective class instructions, and come up with appropriate remedial programs.

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Table 1

Significant Cultural Difference on the Percent of Children Passing the Item on BTBC-R by Grade

	Grade								
	Kindergarten			1st Grade			2nd Grade		
Concepts	American (n=1370)	Chinese (n=100)		American (n=1141)	Chinese (n=100)		American (n=1529)	Chinese (n=100)	
	% Passing	% Passing	h	% Passing	% Passing	h	% Passing	% Passing	h
Narrowest	63	95	-0.86*	74	99	-0.87*	78	99	-0.78*
Fewest	41	94	-1.26*	69	99	-0.98*	85	99	-0.60*
Separate	67	100	-0.86*	89	100	-0.68*	-	-	-
Above	87	100	-0.74*	94	100	-0.50*	-	-	-
Before	82	99	-0.68*	-	-	-	-	-	-
Below	88	100	-0.71*	-	-	-	-	-	-
Next to	99	64	1.09*	-	-	-	-	-	-
Center	76	98	-0.74*	-	-	-	94	100	-0.50*
After	-	-	-	-	-	-	93	100	-0.54*
Skip	-	-	-	-	-	-	96	81	0.50*
Right	-	-	-	84	99	-0.62*	93	100	-0.54*
A Few	-	-	-	93	100	-0.54*	92	100	-0.57*
Medium	-	-	-	86	99	-0.57*	-	-	-
Left	-	-	-	79	99	-0.75*	-	-	-
Pair	-	-	-	55	86	-0.70*	-	-	-
Different	-	-	-	93	100	-0.54*	-	-	-
Matches	-	-	-	93	100	-0.54*	-	-	-
Third	-	-	-	93	100	-0.54*	-	-	-
Between	-	-	-	94	100	-0.50*	-	-	-

* $p < 0.001$

Table 2

Language Characteristics of Concepts Showing Significant Cultural Differences

Concept		Language Characteristics
Narrowest Fewest	最窄 最少	In English, the suffix —est is added to a simple adjective to form the superlative. In Chinese, the word " 最 "(most) is put before an adjective. By adding " 最 ", the superlative meaning is more salient and distinct for Chinese language.
Above Below Left Right	上 下 左 右	Due to the orthographic structure of the Chinese characters, the child has to draw a clear distinction between above and below, left and right, when writing a character. Therefore, understanding these spatial terms is emphasized and reinforced through instruction when a Chinese child learns to write at about age 5.
Third	第三	Chinese language has a more regular ordinal number system. In Chinese, to form an ordinal number, the prefix " 第(di) "is added to a numeral to indicate its order in a set. For example, di-liu "sixth". In comparison, ordinal numbers are more irregular in English.
Before After	在..前面 在..后面	In English, "before" and "after" could carry both temporal (before 5 o'clock; after lunch) and spatial meanings (before the horse; after the bike). Whereas in Chinese, " before " （在..前面）and "after" （在..后面）are clearly spatial, therefore, less confusing for Chinese children.
A Few Medium Separated Match Center Between	一些 中等 分開 對應 中心 在..之間	In English, these terms are lexically more complex because each can have more than one term to express the similar meaning: A Few (some, a bit), Medium (middle, in between), Separate (apart); Match (equal, similar to, competition, a piece of flammable material); Center (middle, a certain place). In Chinese, these are compound noun, preposition, adverb, adjective, or verb, and each term has a rather clear and precise meaning, which facilitates Chinese children's understanding of the concept.
Different	不同	In Chinese, the insertion of " 不 "(not) before an adjective gives the compound a negative potential meaning. Thus, "different" becomes "not same." The meaning is very clear.
Pair	一雙／一對	In Chinese, " 一雙 ", or " 一對 " (pair) clearly carries the meaning of "double or couple."